

WHAT IS CLAIMED IS:

1. A carrier for gene detection comprising:
a base body; and

a polynucleotide immobilized on said base body,
5 said polynucleotide comprising a polynucleotide
selected from the group consisting of:

(at) the polynucleotide of Sequence ID No. 1 in
the sequence listing;

(bt) a modified polynucleotide derived from the
10 polynucleotide (at) by including one or several
deletions, substitutions or additions at any positions
except for 455th position;

(ct) a polynucleotide containing the sequence
which spans from 441st to 455th position of Sequence ID
15 No. 1;

(dt) a polynucleotide containing the sequence
which spans from 449th to 459th position of Sequence
ID No. 1; and

(et) a complementary strand of the polynucleotide
20 selected from the group consisting of (at), (bt), (ct)
and (dt) mentioned above.

2. A carrier for gene detection comprising:
a base body; and

a polynucleotide immobilized on said base body,
25 said polynucleotide comprising a polynucleotide
selected from the group consisting of:

(ag) the polynucleotide of Sequence ID No. 2 in

the sequence listing;

(bg) a modified polynucleotide derived from the polynucleotide (ag) by including one or several deletions, substitutions or additions at any positions
5 except for 455th position;

(cg) a polynucleotide containing the sequence which spans from 441st to 455th position of Sequence ID No. 2;

(dg) a polynucleotide containing the sequence
10 which spans from 449th to 459th position of Sequence ID No. 2; and

(eg) a complementary strand of the poly nucleotide selected from the group consisting of (ag), (bg), (cg) and (dg) mentioned above.

15 3. A carrier for gene detection comprising:
a base body; and
a polynucleotide immobilized on said base body,
said polynucleotide comprising a polynucleotide
selected from the group consisting of:

20 (aa) the polynucleotide of Sequence ID No. 3 in the sequence listing;

(ba) a modified polynucleotide derived from the polynucleotide (aa) by including one or several deletions, substitutions or additions at any positions
25 except for 455th position;

(ca) a polynucleotide containing the sequence which spans from 441st to 455th position of Sequence ID

No. 3;

(da) a polynucleotide containing the sequence which spans from 449th to 459th position of Sequence ID No. 3; and

5 (ea) a complementary strand of the polynucleotide selected from the group consisting of (aa), (ba), (ca) and (da) mentioned above.

4. A carrier for gene detection comprising:
a base body; and

10 a polynucleotide immobilized on said base body,
said polynucleotide comprising a polynucleotide selected from the group consisting of:

(ac) the polynucleotide of Sequence ID No. 4 in the sequence listing;

15 (bc) a modified polynucleotide derived from the polynucleotide (ac) by including one or several deletions, substitutions or additions at any positions except for 455th position;

(cc) a polynucleotide containing the sequence
20 -which spans from 441st to 455th position of Sequence ID No. 4;

(dc) a polynucleotide containing the sequence which spans from 449th to 459th position of Sequence ID No. 4; and

25 (ec) a complementary strand of the polynucleotide selected from the group consisting of (ac), (bc), (cc) and (dc) mentioned above.

5. The carrier for gene detection according to any one of claims 1 to 4, wherein the length of polynucleotide to be immobilized on said base body is no shorter than 15 nucleotides and no longer than 30 nucleotides.

6. The carrier for gene detection according to any one of claims 1 to 4, wherein said base body consisting of conductive substance, and said carrier for gene detection is used as an electrode.

7. A DNA chip comprising:
a base body; and
a first and a second electrodes formed on the base body,

said first electrode comprising a conductive body and at least one polynucleotide immobilized on said conductive body, the polynucleotide being selected from the group consisting of (at) to (et) shown below;

(at) the polynucleotide of Sequence ID No. 1 in the sequence listing;

(bt) a modified polynucleotide derived from the polynucleotide (at) by including one or several deletions, substitutions or additions at any positions except for 455th position;

(ct) a polynucleotide containing the sequence which spans from 441st to 455th position of Sequence ID No. 1;

(dt) a polynucleotide containing the sequence

which spans from 449th to 459th position of Sequence ID No. 1; and

(et) a complementary strand of the polynucleotide selected from the group consisting of (at), (bt), (ct) and (dt) mentioned above,

said second electrode comprising a conductive body, and at least one polynucleotide immobilized on said conductive body, the polynucleotide being selected from the group consisting of (ag) to (eg), (aa) to (ea), and (ac) to (ec) shown below;

(ag) the polynucleotide of Sequence ID No. 2 in the sequence listing;

(bg) a modified polynucleotide derived from the polynucleotide (ag) by including one or several deletions, substitutions or additions at any positions except for 455th position;

(cg) a polynucleotide containing the sequence which spans from 441st to 455th position of Sequence ID No. 2;

(dg) a polynucleotide containing the sequence which spans from 449th to 459th position of Sequence ID No. 2;

(eg) a complementary strand of the polynucleotide selected from the group consisting of (ag), (bg), (cg) and (dg) mentioned above;

(aa) the polynucleotide of Sequence ID No. 3 in the sequence listing;

(ba) a modified polynucleotide derived from the polynucleotide (aa) by including one or several deletions, substitutions or additions at any positions except for 455th position;

5 (ca) a polynucleotide containing the sequence which spans from 441st to 455th position of Sequence ID No. 3;

 (da) a polynucleotide containing the sequence which spans from 449th to 459th position of Sequence ID
10 No. 3;

 (ea) a complementary strand of the polynucleotide selected from the group consisting of (aa), (ba), (ca) and (da) mentioned above;

 (ac) the polynucleotide of Sequence ID No. 4 in
15 the sequence listing;

 (bc) a modified polynucleotide derived from the polynucleotide (ac) by including one or several deletions, substitutions or additions at any positions except for 455th position;

20 (cc) a polynucleotide containing the sequence which spans from 441st to 455th position of Sequence ID No. 4;

 (dc) a polynucleotide containing the sequence which spans from 449th to 459th position of Sequence ID
25 No. 4; and

 (ec) a complementary strand of the polynucleotide selected from the group consisting of (ac), (bc), (cc)

and (dc) mentioned above.

8. The DNA chip according to claim 7, wherein the length of polynucleotide to be immobilized on said base body is no shorter than 15 nucleotides and no longer than 30 nucleotides.

9. A method for detecting validity of interferon therapy for an individual, comprising:

1) contacting a polynucleotide sample taken from said individual with said carrier for gene detection according to any one of claims 1, 2, 3 and 4; and

2) determining the nucleotide sequence of the polynucleotide in said sample, by detecting the hybridization reaction between said polynucleotide sample and the polynucleotide immobilized on said carrier for gene detection.

10. The method according to claim 9, further comprising:

detecting that interferon therapy is valid for said individual if the nucleotide sequence of said sample polynucleotide determined by the determination step is that of the polynucleotide selected from the group consisting of:

(at) the polynucleotide of Sequence ID No. 1 in the sequence listing;

(bt) a modified polynucleotide derived from the polynucleotide (at) by including one or several deletions, substitutions or additions at any positions

except for 455th position;

(ct) a polynucleotide containing the sequence which spans from 441st to 455th position of Sequence ID No. 1;

5 (dt) a polynucleotide containing the sequence which spans from 449th to 459th position of Sequence ID No. 1; and

(et) a complementary strand of the polynucleotide selected from the group consisting of (at), (bt), (ct) and (dt) mentioned above.

10 11. The method according to claim 9, further comprising:

labeling the polynucleotide sample taken from said individual with a marker, prior to the step of contacting the polynucleotide sample with the carrier for gene detection.

15 12. The method according to claim 11, wherein said marker comprises at least one selected from the group consisting of fluorescent dye, hapten, enzyme, radioisotope, and electrode active substance.

20 13. The method according to claim 9, wherein said carrier for gene detection is the carrier for gene detection of claim 6, and the detection of hybridization reaction in the step of determining nucleotide sequence of the polynucleotide in said sample is carried out by detecting electrochemical change accompanied with said hybridization reaction.

14. The method according to claim 13, wherein the detection of electrochemical change is carried out by measuring an electric signal generated between said carrier for gene detection and a counter electrode when voltage is applied between said carrier for gene detection and the counter electrode.

15. The method according to claim 14, wherein an electro-active double strand recognizer which specifically binds to a double strand polynucleotide is added to said hybridization reaction system, and the electric signal generated between said carrier for gene detection and said counter electrode is generated directly or indirectly from the electro-active double strand recognizer.

16. A method for detecting validity of interferon therapy for an individual, comprising:

1) contacting the probe polynucleotide to a carrier for gene detection which has a polynucleotide sample taken from said individual immobilized on a substrate; and

2) determining the nucleotide sequence of said polynucleotide sample by detecting the hybridization reaction between the polynucleotide sample immobilized on said substrate and said probe polynucleotide;

said probe polynucleotide comprising a polynucleotide selected from the group consisting of:

(at) the polynucleotide of Sequence ID No. 1 in

the sequence listing;

(bt) a modified polynucleotide derived from the polynucleotide (at) by including one or several deletions, substitutions or additions at any positions
5 except for 455th position;

(ct) a polynucleotide containing the sequence which spans from 441st to 455th position of Sequence ID No. 1;

(dt) a polynucleotide containing the sequence
10 which spans from 449th to 459th position of Sequence ID No. 1;

(et) a complementary strand of the polynucleotide selected from the group consisting of (at), (bt), (ct) and (dt) mentioned above;

15 (ag) the polynucleotide of Sequence ID No. 2 in the sequence listing;

(bg) a modified polynucleotide derived from the polynucleotide (ag) by including one or several deletions, substitutions or additions at any positions
20 except for 455th position;

(cg) a polynucleotide containing the sequence which spans from 441st to 455th position of Sequence ID No. 2;

(dg) a polynucleotide containing the sequence
25 which spans from 449th to 459th position of Sequence ID No. 2;

(eg) a complementary strand of the polynucleotide

selected from the group consisting of (ag), (bg), (cg) and (dg) mentioned above;

(aa) the polynucleotide of Sequence ID No. 3 in the sequence listing;

5 (ba) a modified polynucleotide derived from the polynucleotide (aa) by including one or several deletions, substitutions or additions at any positions except for 455th position;

(ca) a polynucleotide containing the sequence
10 which spans from 441st to 455th position of Sequence ID No. 3;

(da) a polynucleotide containing the sequence which spans from 449th to 459th position of Sequence ID No. 3;

15 (ea) a complementary strand of the polynucleotide selected from the group consisting of (aa), (ba), (ca) and (da) mentioned above;

(ac) the polynucleotide of Sequence ID No. 4 in the sequence listing;

20 (bc) a modified polynucleotide derived from the polynucleotide (ac) by including one or several deletions, substitutions or additions at any positions except for 455th position;

(cc) a polynucleotide containing the sequence
25 which spans from 441st to 455th position of Sequence ID No. 4;

(dc) a polynucleotide containing the sequence

which spans from 449th to 459th position of Sequence ID No. 4; and

(ec) a complementary strand of the polynucleotide selected from the group consisting of (ac), (bc), (cc) and (dc) mentioned above.

17. A method according to claim 16, further comprising:

detecting that interferon therapy is valid for said individual, when nucleotide sequence of said sample polynucleotide determined comprises the sequence of the polynucleotide selected from the group consisting of (at) to (et) below:

(at) the polynucleotide of Sequence ID No. 1 in the sequence listing;

(bt) a modified polynucleotide derived from the polynucleotide (at) by including one or several deletions, substitutions or additions at any positions except for 455th position;

(ct) a polynucleotide containing the sequence which spans from 441st to 455th position of Sequence ID No. 1;

(dt) a polynucleotide containing the sequence which spans from 449th to 459th position of Sequence ID No. 1; and

(et) a complementary strand of the polynucleotide selected from the group consisting of (at), (bt), (ct) and (dt) mentioned above.

18. The method according to claim 16, further comprising:

labeling said probe polynucleotide with a marker,
prior to the step of contacting it with the carrier for
5 gene detection.

19. The method according to claim 18, wherein said
marker comprises at least one selected from the group
consisting of fluorescent dye, hapten, enzyme,
radioisotope, and electrode active substance.

10 20. The method according to claim 16,
wherein said carrier for gene detection is an
electrode comprising a conductive base and said sample
polynucleotide taken from said individual immobilized
on the base, and

15 detection of hybridization reaction in the step of
determining nucleotide sequence of the sample
polynucleotide is carried out by detecting
electrochemical change accompanied with said
hybridization reaction.

20 21. The method according to claim 20, wherein the
detection of electrochemical change is carried out by
measuring an electric signal generated between said
carrier for gene detection and a counter electrode when
voltage is applied between the carrier for gene
25 detection and a counter electrode.

22. The method according to claim 21, wherein an
electro-active double strand recognizer which

specifically binds to a double stranded polynucleotide is added to said hybridization reaction system, and the electric signal generated between said carrier for gene detection and said counter electrode is generated directly or indirectly from the electro-active double strand recognizer.

23. A gene detecting apparatus for detecting validity of interferon therapy comprising:

a carrier for gene detection according to any one of claims 1, 2, 3, and 4;

a reaction section for contacting a first polynucleotide immobilized on a base body of said carrier with a sample which contains a second polynucleotide labeled with a marker, and putting the first and the second polynucleotides under hybridization reaction condition; and

a marker-detecting apparatus for detecting the marker attached to said second polynucleotide.

24. The apparatus according to claim 23, wherein said marker comprises at least one selected from the group consisting of fluorescent dye, hapten, enzyme, radioisotope, and electrode active substance.

25. A gene detecting apparatus for detecting validity of interferon therapy comprising:

a carrier for gene detection of claim 6,
a counter electrode,
a voltage application means for applying voltage

between said carrier for gene detection and said counter electrode,

5 a reaction section for contacting a first polynucleotide immobilized on a base body of said carrier with a sample which contains a second polynucleotide, and putting the first and the second polynucleotides under hybridization reaction condition; and

10 a measurement section for measuring an electric signal generated between said carrier for gene detection and said counter electrode when voltage is applied by said voltage applying means after said hybridization reaction.

15 26. The gene detecting apparatus according to claim 25, wherein an electro-active double strand recognizer which specifically binds to a double strand polynucleotide is added in said reaction section, and said electric signal is generated from said electro-active double strand recognizer.

20 27. A kit for detecting validity of interferon therapy comprising:

a carrier for gene detection according to any one of claims 1, 2, 3, and 4; and

a buffer solution.

25 28. A kit for detecting validity of interferon therapy comprising:

a carrier for gene detection of claim 6;

a double strand recognizer; and
a buffer solution.